

Remarks

Reconsideration and withdrawal of the objections and rejections set forth in the above-mentioned Official Action in view of the foregoing amendments and the following remarks are respectfully requested.

Claims 1-5 and 7-11 remain pending in the application. Claims 1 and 11 are independent and have been amended herein.

Claim 11 was rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,956,055 (Gibson et al.). Claims 1, 2, 4, 5 and 8-10 were rejected under 35 U.S.C. § 103 as being unpatentable over Gibson et al. in view of U.S. Patent No. 6,227,644 (Perner). Claims 1-4 and 7-10 were rejected under § 103 as being unpatentable over Gibson et al. in view of U.S. Patent No. 5,448,269 (Beauchamp et al.). These rejections are respectfully traversed.

As is recited in independent Claim 1, the present invention relates to a printing apparatus for printing an image on a printing medium while relatively moving at least one of a printing head provided with an array of a plurality of printing elements and the printing medium. The apparatus includes a carriage, detection means and control means. The carriage mounts the printing head and is movable relative to the printing medium in a scanning direction crossing the array of the plurality of printing elements. The detection means is mounted on the carriage for detecting printing positions of an array of printed pixels corresponding to the array of the plurality of printing elements. The detecting means detects printed pixels printed by any of the plurality of printing elements. The control means controls drive timing of the plurality of printing elements according to

detection results of the detection means so as to make printing positions of subsequently printed pixels close to a predetermined center position. The control means controls the drive timing of any of the printing elements that are determined from the plurality of printing elements to have displacement amounts of printing positions of corresponding printed pixels from a printing position of a printed pixel corresponding to one end side of the array of printing elements equal to or greater than a predetermined amount, so that a deviation amount between printing positions of printed pixels corresponding to the one end side and the other end side of the array of printing elements is equal to or smaller than the predetermined amount.

As is recited in independent Claim 11, the present invention relates to a printing method for printing an image on a printing medium while relatively moving at least one of a printing head provided with an array of a plurality of printing elements and the printing medium. The method includes the steps of relatively moving at least one of the printing head and the printing medium in a scanning direction crossing the array of the printing elements so that an array of printed pixels corresponding to the array of the printing elements is printed on the printing medium, detecting printing positions of the array of printed pixels by detecting printed pixels printed by any of the plurality of printing elements and controlling drive timing of the plurality of printing elements according to detection results of the printing positions so as to make printing positions of subsequently printed pixels close to a predetermined center position. The controlling step controls drive timing of any of the printing elements that are determined from the plurality of printing elements to have displacement amounts of printing positions of corresponding printed

pixels from a printing position of a printed pixel corresponding to one end side of the array of printing elements equal to or greater than a predetermined amount, so that a deviation amount between printing positions of printed pixels corresponding to the one end side and the other end side of the array of printing elements is equal to or smaller than the predetermined amount.

Gibson et al. describes a method for compensating for skewed printing in an ink jet printer. This skewed printing may result from alignment inaccuracies of ink emitting orifices in a nozzle plate forming a printhead, “rotational errors” between the nozzle plate and the printhead, rotational errors between the printhead and the carriage assembly, or rotational errors of the carriage relative to the scanning axis. These rotational errors can cause an entire column of ejected ink dots to be rotated relative to an advance direction, that is, be skewed, as shown in Fig. 3. As a result, the bottom-most ink dot placement location in a skewed column printed in a first scan would be offset in the scanning direction relative to the top-most ink dot placement location in a skewed column printed in a subsequent scan.

In order to minimize this offset or error E so as not to be perceptible to an observer, the array of ink emitting orifices in Gibson et al. is segmented into at least two vertically adjacent segments or orifices. The ink dot placement locations for at least one of the segments is shifted in a transverse direction relative to the scanning direction, while the ink dot placement locations associated with the at least one other segment remain unchanged. As shown in Fig. 4, the top four ink dot placement locations are shifted $\frac{1}{2}$ of a

pixel to the left while the bottom four ink dot placement locations remain unchanged. This can reduce the offset or error to $\frac{1}{2}$ of a pixel, which is not discernible by an observer.

Gibson et al. does not specifically describe how the offset or error E is determined. Applicants submit that Gibson et al. does not disclose or suggest that printing elements to be controlled are determined on the basis of displacement amounts of printing positions of printing elements from that of one end side of a printing element array. Thus, it is respectfully submitted that Gibson et al. does not disclose or suggest controlling the drive timing of any of the printing elements that are determined from the plurality of printing elements to have displacement amounts of printing positions of corresponding printed pixels from a printing position of a printed pixel corresponding to one end side of an array of printing elements equal to or greater than a predetermined amount, so that a deviation amount between printing positions of printed pixels corresponding to the one end side and the other end side of the array of printing elements is equal to or smaller than the predetermined amount, as is recited in independent Claims 1 and 11.

Thus, Gibson et al. fails to disclose or suggest important features of the present invention recited in independent Claims 1 and 11.

Perner describes a printer having an image array 15 with two imaging detectors 16 for each nozzle. The ink jet printer of Beauchamp et al. includes a printhead and an optical sensor for sensing a test pattern. The printer controls drive timings of all the plurality of printing elements based on the scanning speed and bending of a platen. Neither Perner nor Beauchamp et al. are believed to remedy the deficiencies of Gibson et al. noted above with respect to independent Claims 1 and 11.

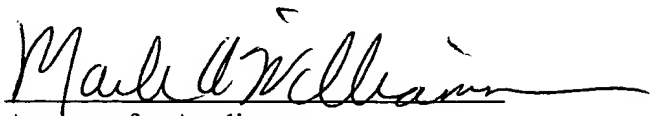
Thus, independent Claims 1 and 11 are patentable over the citations of record. Reconsideration and withdrawal of the §§ 102 and 103 rejections are respectfully requested.

For the foregoing reasons, Applicants respectfully submit that the present invention is patentably defined by independent Claims 1 and 11. Dependent Claims 2-5 and 7-10 are also allowable, in their own right, for defining features of the present invention in addition to those recited in their respective independent claims. Individual consideration of the dependent claims is requested.

Applicants submit that the present application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action, and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,


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